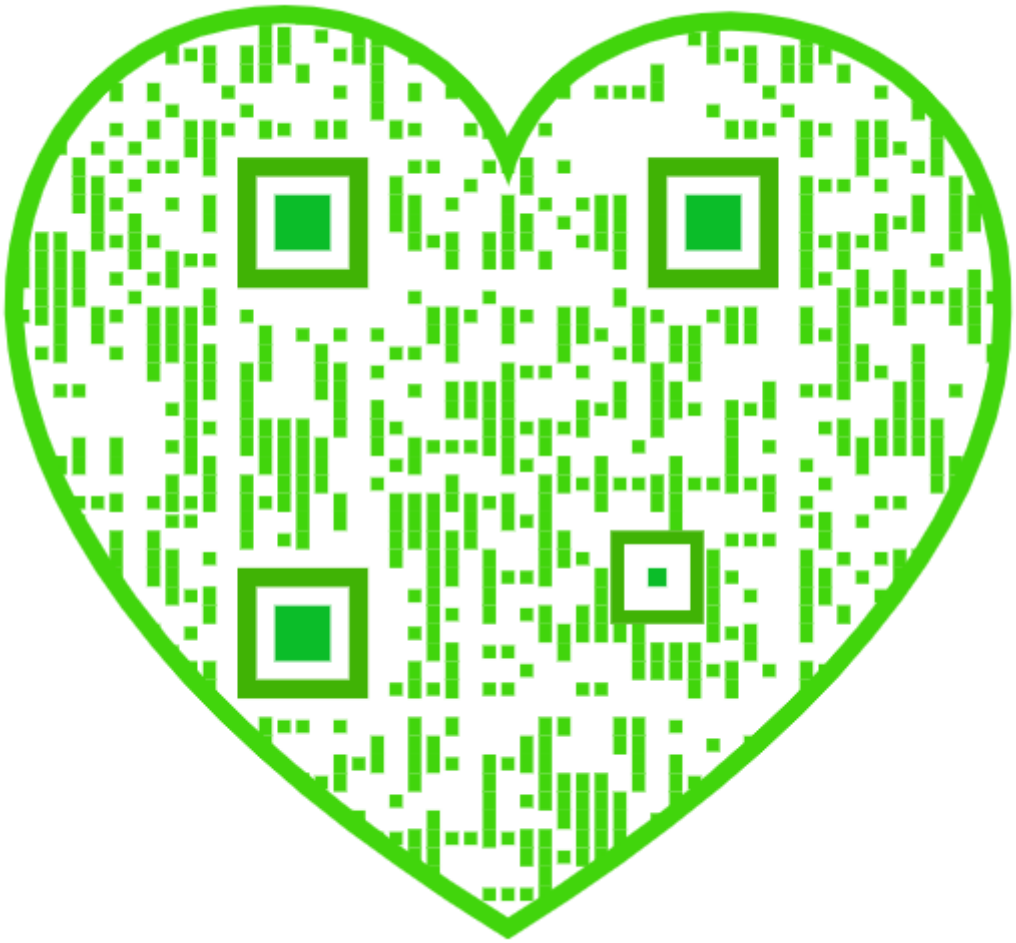
SF
205
.F8

Feeding Cows for Profit



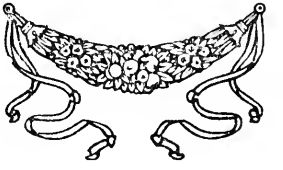
Class _____

Book _____

Copyright No. _____

COPYRIGHT DEPOSIT.

Feeding Cows for Profit



By

VALANCEY E. FULLER

1914

Copyrighted by the Author—1914

.T8

MAY 13 1914

©CLA371920

EVERY dairy cow is breaking down tissue constantly, whether at work or resting and this must be rebuilt by feed.

The body of the cow must be warmed and energy furnished her with which to do her work, and feed is necessary for these purposes. This is nature's demand.

Cows are working hard when giving milk and they naturally need more food than when at rest. They also require the right kind of feed when dry so that they may have the material to grow their calves.

There are three classes of nutrients which must be given cows in their feed to enable them to perform their triple task—protein, carbohydrates (including fats) and mineral matter or ash.

The protein content of the feed makes blood, lean flesh, grows the hair, hide, hoofs and muscular tissue of the calf. It also builds up the broken-down tissue of the cow herself, and, in the case of a heifer, builds up the tissues of the udder.

Caseine is a pure form of protein and cows must be given protein to make the caseine in their milk.

To heat her body and give energy to work the cow must be supplied with the requisite carbohydrates, including fat. In estimating carbohydrates, the fats are worth 2¼ times as much as any other carbohydrates, and are multiplied by this figure and added to the other carbohydrates known as nitrogenous free extract.

There are three main things for which her feed must provide ash or mineral matter: her own bony structure, the bones of her calf, and the small proportion of ash in her milk.

If the ration contains too much protein and too little carbohydrates, the cow can take from the excess protein material to supply the deficiency of carbohydrates; but that is a most expensive and wasteful practice. If the balance is the other way she cannot use the carbohydrates to make up any lack of protein.

If there is a shortage of protein in the feed given a cow that is milking and in calf, she will, true to her maternal instinct, take from her own body the material needed for the growth of her calf, becoming thinner and thinner. Consequently she will not have enough protein left for her maximum yield of milk, and will gradually shrink in her flow and finally cease to give any milk. Nature compels her to put the right proportion of constituents in her milk; and, as caseine, made from the protein in the feed, is one of these materials, when neither the feed nor the body flesh will give any more protein, she must of necessity go dry.

The use an animal makes of its feed is called "burning it up"; and the part which cannot be burned is called mineral matter or ash. This is a very necessary part of the nutrients, as bones make up about six to nine per cent of the body of the dairy cow and ash makes up about

70 per cent of the bones. In the flesh, muscles, etc., there is a trifle short of one per cent of ash, and there is also mineral matter in the blood, as well as a small percentage in the milk. Ash has a definite part in the economy of the cow and her products and we must give it to her in her feed.

A balanced ration is one in which, experience has taught, the proportion of protein to carbohydrates is such that there is no waste of the feed given for the cow's highest production.

In speaking of protein and carbohydrates throughout this booklet we refer only to digestible nutrients: that is, such portions as are digested and assimilated by the cow.

Experience has taught that for every pound of protein the cow should be fed from five to six and a half pounds of carbohydrates, including fat. This would have a ratio of 1:5.0 or 1:6.5. The ratio is the relation the protein bears to the carbohydrates, and is found by dividing the total carbohydrates by the total protein in the feed. As for example: if the ration contains a total of 2½ lbs. of protein and 13.5 lbs. of carbohydrates, dividing the carbohydrates by the protein we get a ratio of 1:5.4.

If the ration has less than 5 lbs. of carbohydrates to every pound of protein, or, as it is expressed, 1:5.0, it is called a narrow ration; if it contains more carbohydrates than 6.5 lbs. to 1 lb. of protein it is called a wide ration.

We must so feed the cow that when dry she will be able to live and keep her body in good condition without losing or gaining in weight. This is known as a maintenance ration.

No hard and fast rules can be laid down for feeding dairy cows. Each cow is a law unto herself. One cow is more nervous than another; each differs from the other in the amount of nutrients necessary, first for maintenance, and second for production.

While no one ration is equally adapted to all cows, even of the same weight and giving approximately the same amount of milk and fat per cent, science and practice have given enough data to enable us to approximate the amounts of digestible protein and carbohydrates usually needed for maintenance and the production of a certain quantity of milk and fat; but the feeder must test out each individual cow.

THE BEST RATION IS ONLY A GUIDE AND IS NOT APPLICABLE TO ALL COWS.

SUCCULENCE

Of the four requisites in a ration, succulence, palatability, digestibility and fat, succulence in our opinion is the most important; because when a succulent is fed with other roughage and grains, it renders them more palatable and aids in their digestion; as, for instance, June pasture, which is known to be nature's best food for the dairy cow, although it contains 80 per cent water. When a cow is at pasture, all she has to do

is to eat all the grass she possibly can and she will give all the milk she is capable of, and at the lowest cost for production. This demonstrates the need and value of succulence.

Corn silage is the cheapest succulent that can be given the dairy cow, both winter and summer. She is very fond of it and will leave even bright alfalfa hay or grain to eat her silage. It can be grown very cheaply. A thousand-pound cow can easily eat as much as 35 lbs. a day, at a cost of a little over six cents, if silage is $3.50 per ton, and so save 10 lbs. of hay, which would cost 12½ cents, at $25 per ton. Not only this, but she will give more milk, keep herself in better condition and assimilate her food better.

It has been proven by the work at the New Jersey Station in 1913 that corn silage can be grown, placed in the silo, and fed at less cost during the summer, than soiling crops. It has the advantage that once in the silo it is not affected by drought, as soiling crops are. The needed help can be hired at the time of harvesting the corn for the silo; it is on hand at all times: whereas, men and teams have to be sent out at least once, and generally twice a day to cut the soiling crops, and if drought comes there is a shortage in yield.

Other forms of succulence are roots—turnips, mangels and beets. These are much relished by the cow and seem to produce some effect that makes them more beneficial as a feed than chemical analysis would indicate. While there is a large proportion of water in them, it is a great deal like the juice of an apple: it has a salutary effect on the kidneys and liver. The majority of farmers object to growing roots on account of the labor. While they are far more expensive than corn silage, the labor put into their cultivation is most beneficial to the land and makes a good return on the crop the following year.

Turnips, if liberally fed, have a tendency to taint the milk unless fed immediately after milking.

Roots can never compare in economy with corn silage.

Another form of succulence of comparatively recent use is dried beet pulp, which is referred to later.

While molasses can hardly be considered a succulent, where there is no succulence it is desirable to feed a small amount of it, or to use some of the good molasses feeds. One of the benefits of any succulent is its action on the bowels of the cow; and where it is lacking molasses seems to take its place to a limited extent. It is best to dilute it with hot water before using, and it is especially indicated where the hay or other roughage is of poor character and does not appeal to the cow's taste. Cows like molasses so well that they will, for its sweetness, eat roughage they otherwise refuse to touch.

Where molasses is fed, not more than one pint should be used at first, gradually increasing the amount, watching the droppings all the time, but do not feed beyond one and one-half quarts per day to a thousand-pound cow. If too much is fed at first the cows will scour.

If there is no succulence and the feeder objects to molasses on account of mangers becoming sticky and does not wish to use any prepared feeds, the ration should contain some linseed oil meal, old process.

PALATABILITY

It is most essential that a cow's food should appeal to her appetite. Far too little attention is paid to this phase of feeding. Feeders are particular to balance their ration, yet seem to care little whether its composition will please the taste of the animal. In all our dealings with cows and their peculiarities, we have always tried to think what would be good for a human being and apply it to the cow.

We know how our appetite can be affected by the appearance of food on our table. Many a person sits down not feeling hungry, but if the table is so ordered that it pleases the taste, and what is there is appetizing, the appetite will be improved. While the eye of a cow does not play so important a part as the human eye, the bovine sense of smell is much more acute, and the cow depends largely on it to know whether the feed before her is palatable. To demonstrate this we have only to give some hay that has been messed over by another cow and see how it will be avoided, except in a case of extreme hunger.

We have seen that a cow must be fed a certain amount of food to sustain life, that of the fœtus, and to make milk. If we feed her but a maintenance ration, after she has taken the needed material from her own body she cannot make any more milk. It follows that the surplus feed over that which is for maintenance is used to make milk; and that the more feed we can get her to eat within a safe limit, the more milk will she make. That is one reason we all love a good feeder.

How are we to make the feed palatable? First by feeding in a clean manger; never letting anything stay in it to mould. If we feed more roughage than is eaten up, the manger should be cleaned out immediately after the cow has done eating, because she makes the hay unpalatable by breathing on it.

As to the grain mixture, two grains are more palatable than one, and three still more so. Another reason three grains should be preferred is that two may lack in ash and the third may give it.

Our experience has been that when a cow likes her feed she makes a lot of milk on it.

Pasture is very palatable to the cow; she will often eat 80 lbs. a day. But, when dried, unless she likes it, she will not eat more than 18 to 20 lbs.

Cows will eat more corn silage than corn stover. The former pleases the appetite and the latter does not.

One of the best results of palatability is that it starts the flow of saliva, a great aid to digestion.

DIGESTIBILITY

The value of all food is in the part that is digested. The balance passes away in excrement.

Mastication is the first step in digestion, the chewing or breaking up of the food to make it ready for the stomach juices. In the process of chewing the food is moistened by the saliva, which hastens the process of digestion and produces some chemical changes in the constituents.

It is unquestioned that the secretion of the digestive fluids is controlled by the nervous system. Digestibility is aided by palatability. This accounts to a great extent for the success of one feeder over another where the same grains or roughages are used by both. One makes his ration appetizing to the cow; the other fails to take this into account. One tempts the cow's appetite, the other does not.

It has been conclusively proven by experiments in this country and Germany that no good follows the cooking of feeds. The reason is that the protein is rendered less digestible. Some seem to think that the oftener a cow is fed the better will be her yield. We have not found it so. We believe that regularity in feeding is more important than the number of feedings per day, provided she is given all she will clean up. Digestion does not always mean production. In the last analysis the cow herself, the breed, her health and surroundings, all affect what she makes out of the food we give her. One instance of this is the fact that you cannot feed fat into milk. You can increase the milk flow; but the animal herself, according to her breed and the state of development of her natural characteristics will put into it the fat and solids Nature provides that she shall.

FATS

All dairymen know that fat in milk of the same cow may vary greatly at different periods, and will vary materially in the first drawing and the strippings.

While a cow's milk may vary in the per cent of fat from day to day and from milking to milking, every cow is born with the ability to give a certain fat, which she will average in the long run.

Changes in feed will often temporarily change the fat—that is for a few days—but the cow will come back to her old fat again very shortly, provided she has been reasonably well fed and is giving her normal flow. A cow poorly fed may give a slightly lower fat than her normal per cent, but she is born with a fixed normal fat, which varies more with the breed than anything else. The longer the cow is in lactation, the higher will her fat be, within her own limit.

It is well known that strippings are extremely rich in fat, and the milk first drawn is low. In an experiment conducted by Prof. Babcock in Trial No. 1 the first milk contained but 1.32 per cent fat and the stripping 9.63 per cent; in the second trial, the first milk contained but 1.07 per cent fat and the strippings 10.35 per cent. The solids other than fat were about the same in fore milk and strippings.

For some time it was thought that the fat in milk was taken from the fat and protein in the feed. It is now generally conceded that not only the fat or oil in the feed, but the protein content, as well as the carbohydrates other than fat contributes to that end.

It is well known that when a cow is fed a rich protein ration while dry, she will store a lot of lean meat on her body and is enabled in some mysterious way to give an abnormal percentage of fat in her milk when she freshens. As the lean meat works off her body the fat per cent becomes normal.

FIBRE

The value of a feed is determined not only by the amount of protein, carbohydrates (especially fats) and ash, but also by the amount of fibre, which is called crude fibre. This is the tough or woody part of the roughage, or of the plant or grain from which the feed is made. It consists largely of cellulose or cell tissues. The best examples are the lint of cotton and of wood pulp. Certain States make laws against selling feeds that have too large a proportion of crude fibre, because it is very hard of digestion, and beyond a certain stage the more crude fibre there is in a feed the less valuable it is. Dairymen should reject any feed that has too much fibre in it.

The amount varies, but as a rule the larger the plant the more fibre. Dry matter in the trunks and limbs of trees is mostly woody fibre; there is more in the stems than in the foliage.

Grass and other herbages are low in fibre; beets, turnips and potatoes have less than grass. In the former there is more fibre in the leaves and stems than in the tubers themselves. In grains and seeds the fibre is mostly in the outer coatings, while the interior has little. That is one reason bran is difficult to digest, while ground corn (which has the whole of the grain), gluten meal, or any other feed made from the interior part of the grain is easy for the cow to digest.

Straws are very high in crude fibre, which is one reason, apart from the lack of nutrients, that they are poor feeds. Hays also have much fibre.

The stage of growth at which plants are used for fodder has a great influence on the proportion of crude fibre. The younger they are, the less fibre, and the older, the more fibre. Here is one reason early cut hay is more beneficial to the cow than late. Pasture grass has little fibre and the early cut grass less than that which has ripened. The difference is due to the greater proportion of woody fibre and the decrease in water in the tissues.

ROUGHAGES

The cow is a ruminating animal and as such must have a large quantity of roughage in her paunch, it being her nature. She eats much grain, and if there is not a goodly lot of roughage to break up or mix the grain, it packs and is harder to digest. She has then to use up more energy to digest her food, which energy should be used to make milk and fat. Do not stint your cow's hay or fodder: it is a cheap feed for the place it fills and a prime necessity in dairy production.

Dairymen should be able to make their own rations and to grow their feed instead of buying it. To help toward that end is one reason for writing this booklet.

Roughage forms a very important part of every dairy ration; because two-thirds of the dry matter should be furnished through it. As roughage is usually grown on the farm, two-thirds of the nutrients are provided from home grown crops in this form.

A thousand-pound cow, giving from 22 to 30 lbs. of milk, according to her fat, will need from 24 to 26 lbs. of dry matter, about 2½ lbs. of protein and from 13¾ to 15 lbs. of carbohydrates per day.

As two-thirds of this dry matter amounts to 16 to 17 1-3 lbs., as the case may be, it will be seen what an important part roughage plays in making a ration.

It stands to reason that if roughage is lacking in protein and has too much carbohydrates, it will be needful to feed grains rich in protein and low in carbohydrates. These are usually the by-products, such as cottonseed and linseed oil meals, gluten feed, distillers' dry grains and brewers' grains. Reference to the table in another part of this book, showing the analysis of all the feeds, and the table showing the cost per ton, will show that those feeds rich in protein usually cost the most per ton, though giving the protein at the lowest cost per pound. It also follows that the lower the protein in roughage, the more money the farmer has to pay for grains. This shows the need of growing on the farm alfalfa, clover hay, oat and pea hay, soy bean hay, crimson clover, cowpea hay, or alsike clover, all of which are high in protein; and most of which benefit the land they are grown on.

Dairy farmers who have seen the paunch of a cow opened and noted the amount of roughage she carried, should readily realize the need for giving a large amount.

Some cows are so heavily grained week in and week out that they have no appetite for roughage; and if this is persisted in for generations it will produce cattle without sufficiently large paunches to hold the cheapest of all feeds—roughage.

Our experience is that a cow with a very deep paunch, indicative of a large stowage capacity, will produce her full limit of milk, and live longer than a cow lacking girth, and will usually produce more milk and butter at less cost per pound.

In making a ration, the exact amount of roughage the cows consume should be included. Feeders should therefore be careful to know that the amount they have set down is the exact amount consumed, and none is wasted. The best plan is to weigh in the roughage the first day the ration is fed, and weigh back any left over. Then alter the ration to accord with the exact amount consumed.

ROUGHAGES

Reference to the tables of digestible nutrients found on pages 22 and 23 shows the amount of dry matter, protein and carbohydrates each roughage gives, as well as the ratio.

We have seen that two-thirds of the dry matter should be taken from the roughage, and, as it is generally wise to make a ration, as a basis, containing from 23 to 24 lbs. of dry matter, about 2.5 lbs. protein and from 13.75 lbs. to 15.5 lbs. carbohydrates, it follows that the roughage should supply from 16 to 17 lbs. of dry matter.

The ratio of the roughage has an important bearing on the cost of the grain used with it. If the roughage contains little protein compared with the carbohydrates (or the ratio is wide) it will be necessary to use much more grain or feed to give protein than where the roughage provides a goodly quantity. In the former case the grain or feed must be high in protein to properly balance the ration; and we have seen that this class of feed costs the most per ton.

GREEN FODDERS

Turning again to the table of digestible nutrients on pages 22 and 23, we see great variations in the amount of protein in soiling crops as well as in their ratios.

We will divide them into three classes: first, those where one pound of any green fodder gives between .01 lbs. and .019 lbs. protein, namely corn silage, fodder corn, peas and barley, peas and oats and cowpeas; second, those in which one pound gives from .02 lbs. to .029 lbs. protein, namely, pea vine silage, Hungarian grass, rye, pasture grass, crimson clover, alsike clover and red clover; third, those where one pound of fodder exceeds .029 lbs. protein, namely, soy beans, alfalfa, sorghum and millet.

It follows that those in the first class give the least protein in a ration and those in the third class supply the most.

For instance, 15 lbs. of fodder corn give but .15 lbs. protein, where a like quantity of alfalfa gives .585 lbs.

In considering which fodder to grow to supplement pasture, we must take into consideration the character of the dry hay we have on hand.

If we are feeding alfalfa hay, which has a ratio of 1:3.8, we should feed with it a green fodder which contains a good deal of carbohydrates to widen the ratio. We have found corn silage as not only the cheapest but it has given the best results with alfalfa. If that cannot be used, feed fodder corn, millet or green sorghum.

If we are feeding mixed hay, which has a ratio of 1:7.4, we should use a green fodder with a fairly narrow ratio, such as red clover, cowpea, rye, etc.

We have found this a good rule: where the ratio of the hay is narrow, use a green fodder with a wide ratio; if the hay ratio is wide, use a green fodder with a narrow ratio, such as peas and oats, crimson clover and soy bean.

DRY FODDERS

Turning to the consideration of the dry hays, we note ten pounds of timothy hay gives but .28 lbs. protein and 4.65 lbs. carbohydrates, and is extremely wide in its ratio; where a like quantity of mixed hay gives .62 lbs. protein and 4.6 lbs. carbohydrates, and has a moderately narrow ratio. Clover hay provides .68 lbs. protein and 3.96 lbs. carbohydrates and alfalfa 1.1 lbs. protein and 4.23 lbs. carbohydrates.

If we study the rations found later on for a practical application of the benefit of using a high protein hay narrow in ratio, we will see that we need not use so many pounds of grain with such hay, or that the grain or feed we combine with it costs less per ton. On the contrary, when we feed a low protein hay with a wide ratio, we not only have to feed more grain with it, but that grain costs more per ton.

Apart from its low protein, timothy hay is woody—has a large amount of fibre—is difficult of digestion and uses in assimilation a large amount of the cow's energy. In fact, it is no feed for the dairy cow, nor is she fond of it. It usually commands a higher price than either

clover or mixed hay. Farmers who do not have alfalfa or clover to feed with timothy had better sell the latter and replace it by clover hay if possible, or at least with mixed hay.

By consulting the table of digestible nutrients on pages 22 and 23 we find that 10 lbs. of alfalfa hay gives 1.1 lbs. protein; 10 lbs. of soy bean hay gives 1.06 lbs.; cowpea hay, 1 lb.; crimson clover, 1.05 lbs.; red clover, .84 lbs.; oat and pea hay, .76 lbs., and mixed hay, .62 lbs. These figures show the relative value of these hays in providing protein and their figures show the relative value of these hays in providing protein and their economic value in feeding.

It may be broadly stated that the higher any hay is in protein, the more feeding value has it.

We often marvel that dairymen will not learn the greater profit there is to them in growing and feeding alfalfa, clover, oat and pea, soy bean and cowpea hays.

STRAWS AND FODDERS

A further study of the tables will show that straws and corn fodders are low in protein, have a very wide ratio, are deficient in dry matter and of low feeding value.

CORN SILAGE

The necessity of feeding cows some succulence the year through is generally recognized.

The value of corn silage as an economical succulent for winter feeding is thoroughly appreciated by all good feeders.

When fed with clover, alfalfa or soy bean hay, a good ration can be made for cows giving from 20 lbs. of rich milk to 22 lbs. of thinner milk a day. But when the milk yield exceeds these amounts, roughage must be supplemented by grain.

SUMMER SILAGE

In later years it is becoming apparent that corn silage is the cheapest and best source of the necessary succulence during the summer months when pastures fail; and the best feeders are now depending on silage for that purpose, rather than on soiling crops. To provide sufficient silage to carry over the summer feeding additional silos are constantly being built so that enough silage may be had for that purpose; and when new silos are being erected, sufficient capacity is being provided for summer silage. This is the height of wisdom.

It is not so injuriously effected by the changing seasons or by drought as soiling crops.

It is easier and more economical to plant and cultivate a large acreage of silo corn than to continuously plant and cultivate soiling crops through the summer.

Peas and oats are the crop which in most localities is the mainstay of the soiling system. Now that alfalfa hay is growing in popularity, we have found it a most difficult problem to balance properly a ration

with alfalfa hay as a roughage and green alfalfa or green oats and peas as a succulent where soiling is practiced. Alfalfa hay has a ratio of 1:3.8; green alfalfa, 1:3.5; green oats and peas, 1:6.1; whereas corn silage has a ratio of 1:14.3.

If 12 lbs. of alfalfa hay is fed, and 30 lbs. green alfalfa also, the combination will produce 2.49 lbs. protein and 9.216 lbs. carbohydrates, with a ratio of 1:3.7. If we substitute 30 lbs. green oats and peas for the green alfalfa the combination will produce 1.86 lbs. protein, 8.406 lbs. carbohydrates, and have a ratio of 1:4.5. If we feed 12 lbs. of alfalfa hay and 30 lbs. corn silage, they will give 1.59 lbs. of protein and 8.946 lbs. carbohydrates and have a ratio of 1:5.0.

SAVING WITH SILAGE

While it is admitted that succulence is needed at all seasons, and that where it is part of the ration the milk flow increases, there are still those who doubt if it is as economical a feed as is claimed. Let us take some concrete examples of cost.

Turn to tables A, B, C and D, following this chapter, where this question is worked out in a practical way.

It will be seen in table A that 20 lbs. of clover hay has provided 1.36 lbs. protein and 7.92 lbs. carbohydrates at a cost of 18 cents. In table B it is shown that 12 lbs. of the same hay and 35 lbs. silage have together produced 1.131 lbs. protein and 9.267 lbs. carbohydrates, and that it needs but 3-5 of a pound of cottonseed meal to practically equal the protein given by 20 lbs. clover and exceed the carbohydrates. The saving through silage will be noted as 1.53 cents. In a dairy of 25 cows this means a saving of $69.80 per six months, to say nothing of the increased milk flow.

Figuring the same way by tables C and D where alfalfa hay is fed in one ration and alfalfa and corn silage in another, we find the saving in cost of feed through use of the latter is equal to $73.00 for six months where 25 cows are fed.

TABLE A.

	Ratio	Dry Mat. lbs.	Protein lbs.	Carbs lbs.	Per Ton	Cost
20 lbs. clover hay	1:5.8	17.00	1.360	7.920	$18	$.18

TABLE B.

12 lbs. clover hay		10.20	.816	4.752	18	$.102
35 " corn silage		7.35	.315	4.515	3.50	.0525
3/5 " cottonseed		1.09	.223	.266	34.00	.0102
		18.64	1.354	9.533		.1647

The saving by silage $.0153 per day.

TABLE C.

20 lbs. alfalfa hay	1:3.8	18.40	2.200	8.460	24.00	.24

TABLE D.

12 lbs. alfalfa hay		11.04	1.320	5.076	24.00	.144
35 " corn silage		7.35	.315	4.515	3.50	.0525
1½ " cottonseed		1.38	.558	.666	34.00	.0255
		20.77	2.193	10.257		.222

The saving by silage $.018.

DRIED BEET PULP

Heavy feeds may be lightened by the use of dried beet pulp and it is also recognized as a most excellent succulent. Neither corn silage nor roots can be used to lighten heavy feeds; and in this respect beet pulp has an advantage over them.

When the sugar is extracted from the beet pulp, the residue is dried at once, which makes it very light; it is immediately packed in sacks for shipment, and will keep indefinitely.

Like roots and silage, the benefits which follow the feeding of dried beet pulp cannot be determined by any chemical analysis of it.

Those who have corn silage or roots will find it a most excellent form of succulence; and where roots and corn silage can be had, the best results have followed the feeding of dried beet pulp with either or both.

We have already seen that where we feed heavy grains, it is needful that light ones be mixed with them so that the stomach juices may act readily. Dried beet pulp being bulky and extremely light aids very materially in the digestion of other grains fed with it, as it enables the gastric juice to get at all the feed and so aids in ready assimilation. Strange as it may seem, some carefully conducted experiments with which we are familiar have demonstrated that the same amount of dry matter in dried beet pulp as is contained in the sugar beets themselves produced more milk. We believe this is due to the lightening quality of the beet pulp.

It has proved to be a most excellent succulent for dry cows. It is cooling, keeps the bowels in good condition; can be stored in a comparatively small space; keeps, as we have said, indefinitely; and is most successful in maintaining the flow of milk when cows are on the show circuit.

COMPARISON OF COSTS

When we have to pay $26 per ton for beet pulp while corn silage costs only $3.50 per ton in the silo, the natural presumption would be that the former would cost enormously as a feed, compared with silage; but it is generally conceded that one pound of dried beet pulp has as much feeding value as 5 lbs. of corn silage. It will be seen by the table below that 4.4 lbs. of the beet pulp will give as much protein as 30 lbs. of silage, and that the cost of the former is only about ½ cent more than the latter. We prefer to feed it soaked the night before for the morning feeding, or in the morning for the afternoon feeding, using as much water as it will readily absorb, about one to four or one to six parts. We also prefer to feed it mixed with the grain. Many people like to feed it dry; but if this is done the cows should have an extra allowance of water.

It is conceded that 1 lb. dried beet pulp has the same feeding value as one pound of corn; and it has the added value of succulence.

COSTS OF SILAGE AND BEET PULP COMPARED

	Protein	Carbs	Per Ton	Cost
	lbs.	lbs.		
30 lbs. silage	6.30	.270	$ 3.50	$.0525
4.4 " beet pulp	4.05	.273	26.00	.0572

ROOTS

The chemical analysis of roots does not begin to tell their full benefit as milk makers. True, there is a large amount of water in them; but that the water—juices in reality—have a most beneficial effect on the health of the cow in regulating the bowels and kidneys is beyond dispute. They help to keep the cow in a healthy, thrifty condition. ALSO COWS ARE CAPABLE OF THEIR BEST PRODUCTION ONLY WHEN THEY ARE IN SUCH CONDITION.

We have found that even when there is an ample supply of corn silage the milk flow is improved by substituting some roots for silage.

GRAINS

One of the general principles of mixing grains in a ration is that light grains should be mixed with heavy ones to aid in the more ready assimilation of the latter. Unless this is done the heavy grains are apt to lay in the digestive tract and are difficult of digestion. Heavy grains will be found in the tables on pages 24 and 25 in heavy type. Those in lighter type are the lighter grains.

Heating feeds such as cottonseed meal, gluten and corn should be combined with cooling feeds such as bran, ground oats, distillers' dried grains or linseed oil meal.

In selecting his grain mixture, the feeder should see that it is so combined that the droppings of the cows will be in good condition, neither too loose nor too hard; that variety is given by using at least three kinds; that succulence is supplied and that there is a fair proportion of ash.

Where three grains are combined, there is usually enough ash in one of them, especially if alfalfa, mixed hay or clover is fed.

It is not our purpose to go into a general discussion as to the analysis of grains, their source, etc., but we will content ourselves with some general remarks as to their application to feeding and how they can best be combined, taking them in the order in which they appear in the tables on pages 24-5.

CORN MEAL

We always like to have corn meal in a ration to keep cows in good condition, adding or subtracting it according as the cows get too thin or too fat; and regardless of whether it unbalances the ration or not.

Corn meal is very heating and rather constipating. If fed to excess without being combined with other grains, it tends to dry the cows up; but it is nevertheless one of the best feeds for keeping cows in good condition.

This grain is fairly low in oil, and it and all its byproducts such as distillers' dried grains, gluten feed, gluten meal, hominy chop, corn silage, etc., are low in ash. It is a carbonaceous feed. Corn is one of the most easily digested of all grains, and cows are extremely fond of it.

HOMINY CHOP

This is not nearly so heating as corn. The amount of fat in the former is double that in corn meal. It too is a carbonaceous feed.

Many cows will do well with hominy added to their feed and not so well where corn meal is used.

GROUND OATS

There is no feed which cows will relish for so long a time as ground oats; or which can be fed so continuously without their stalling. It is cooling, light, and can be mixed with heavy feeds in the place of bran.

Notwithstanding what has been claimed to the contrary, it is our experience, backed up by the results of feeding twenty-five cows for 124 days in the World's Fair Dairy Test at Chicago in 1893, in which each day's butter was scored by competent experts, that ground oats impart a high flavor to the milk.

Ground oats are fairly rich in ash and fat. They may be fed in goodly quantities.

BARLEY CHOP

Barley chop has considerable feeding value and is much used in Denmark, usually with oats, and also on the Pacific slope.

It should be rolled, not ground, because when finely ground it becomes pasty.

This grain is high in crude fibre compared with corn and oats and low in fat; while it is fairly rich in ash.

When, for any reason, barley has become injured so that it cannot be sold on the open market, it can be used to advantage in feeding dairy cows.

RYE FEED

Cows do not take readily to rye feed. If fed to excess it gives an undesirable flavor to milk. It is low in fat and in ash; is slightly higher in digestible protein than corn and has a narrow ratio. It is not commended for dairy cows.

RED DOG FLOUR

Red Dog or Dark Feeding Flour is quite a little higher in protein than standard middlings or wheat bran, and contains more carbohydrates than either. It is also rich in fat. It is highly esteemed by those who have fed it. Owing to the fact that there is considerable pasty or doughy substance in it, it must be fed in limited amounts, or it will cause impaction of the manifold. It can be used to advantage in balancing a ration which is narrow and needs to be widened.

This is classed as a heavy feed and is low in ash.

WHEAT BRAN AND MIDDLINGS

Bran and middlings are so well known and so much used that little need be said of them. They differ in that bran is a light feed and is used to advantage with heavy feeds, whereas the middlings are classed as heavy.

Bran is laxative and cooling and rich in ash, one of the best feeds for young and growing stock.

Care must be used in feeding wheat midds, as they have a tendency to pack if fed to excess.

We do not care to feed more than 2½ to 3 lbs. to a thousand-pound cow, the former preferably.

Wheat midds, are fairly rich in ash, but not nearly so much so as bran.

BREWERS' WET GRAINS

When fed in reasonable amounts and while fresh, wet grains, with hay and other grains, are milk makers and safe.

If, however, they are fed when partially rotted, the juice from them produces very objectionable odors from anything into which it may soak.

They are rich in protein and low in carbohydrates and consequently narrow.

To a certain extent they take the place of a succulent.

We have fed as much as 4 lbs. per cow per day with bulky grains, and with plenty of roughage, with good results.

When fed to excess or as the only grain, they make so much blood that they wear out the cow or cause udder trouble.

They are laxative and if a fair quantity is fed but little bran or linseed should be fed with them. They are deficient in ash.

DISTILLERS' DRIED GRAINS

These are light and bulky, resembling bran in the latter respect; are very high in protein, low in carbs. and rich in fat.

They have a feeding value double that of bran; are not so heating as cottonseed or gluten feed; and not apt to give udder trouble.

Three and a half to four pounds can safely be fed a thousand-pound cow a day. We prefer them to gluten feed, malt sprouts or brewers' dried grains as a concentrate, and they are great milk makers. Like all the by-products of corn, they lack ash.

There are two kinds of these grains, those made from rye and those made from corn. The former are not to be compared in feeding value with those from corn, which are usually marketed under some trade name such as "Ajax Flakes," "A B C Grains," "Four Ex-Grains," "Three D Grains," "Continental Gluten Feed," etc.

Feeders not familiar with these grains should be sure they are getting those made from corn when they buy, as they are generally from $7.00 to $9.00 per ton higher in price than the rye grains.

With the possible exception of linseed oil meal, we consider distillers' dried grains made from corn the safest of all the heavy concentrated feeds.

GLUTEN FEED

Gluten Feed, which is made of gluten meal and corn bran ground together, is another valuable concentrate when fed in moderation.

It is classed as a heavy feed.

While this feed nearly equals distillers' dried grain in protein, it does not have anything like the same fat. It should be fed with some light or cooling feed like bran or ground oats; because unless the amount is limited or the mixture is properly combined, the udders may be injured.

We do not advise feeding more than from 2½ lbs. to 3 lbs. per day to a thousand-pound cow, and prefer the former amount.

LINSEED OIL MEAL

Next to cottonseed meal, linseed meal supplies a pound of protein at the least cost of any grain feed. The old process meal is the kind that is generally used. It differs from the new process by having the oil pressed out, while the new process meal has it extracted by ether. In this chapter we have reference solely to old process meal.

This meal is a splendid fitter and tends to make the coat glossy and the skin pliable and unctuous to the touch. It is laxative, is not heating, and seems especially beneficial when fed with alfalfa hay, not more than 1½ lbs. to 2 lbs. to a thousand pound cow; and where bran, corn silage, roots or beet pulp are fed, care must be exercised to see that the bowels are not loosened too much.

Apart from its nutritive value, linseed has a most beneficial effect on the health of the cows.

A little should be fed for at least three weeks to all cows and heifers coming in, as when this is done they seldom retain the afterbirth.

COTTONSEED MEAL

Cottonseed meal gives a pound of protein at the least cost of all grains, at prices usually prevailing.

Unlike linseed, cottonseed is both heavy, heating and constipating. It must always be fed with a light feed and is indicated where bran and considerable succulence is already part of the ration.

It is a great milk maker and also a great blood maker.

Not more than 2 lbs. a day should be fed to a thousand pound cow; and none should be fed to calves.

The opinion prevailed and is still held by some, that cottonseed meal tended to produce abortion. This is wholly erroneous. The meal made from seed cannot do so; but the extract from the root will.

PREPARED OR COMMERCIAL FEEDS

Some years ago it was very fashionable at some of the Experiment Stations to speak disparagingly of prepared or commercial feeds. No doubt in some cases there was good cause; but of later years vast improvements have been made in the manufacture of all these feeds, until to-day they occupy a legitimate place in the economy of cattle feeding.

Stringent laws have been passed by the Legislatures of nearly all States, amply protecting the purchaser who buys prepared feeds, and showing him exactly what he is getting. That there is merit in them is demonstrated by the fact that notwithstanding all the tirades that were in many cases unjustly indulged in against them, they are being fed in ever increasing quantities.

While we prefer to mix our own grain rations, rather than to buy or use prepared feeds, many feeders never could compound for themselves as well balanced or as economical rations as they can buy already prepared. When, however, any manufacturer advertises as a fact that his ration is a balanced one, intimating that it can be so balanced with all roughages, he is making a mis-statement; because there is no ration of which the same quantity will balance with all roughages.

It is a fortunate thing for dairymen that these prepared feeds can be purchased. They have unquestionably had a tendency to keep down the cost of all standard grains and have utilized to advantage many of the by products which formerly went to waste. High as the prices of standard grains are to-day, they would have been still higher but for the competition of prepared or commercial feeds.

Prepared feeds have come to say. Those honestly made have a legitimate place in the economical feeding of dairy cows. It stands to reason that where such enormous amounts of the various grains are bought by the manufacturers as are used in making commercial feeds, they can buy much cheaper than single purchasers; yet I have never failed to be able to make a ration from standard grains and feeds containing equal nutrients and as well balanced as any prepared feed, at less cost. In the appendix to this booklet will be found a list of prepared or commercial feeds I have tried out, of which I approve and can recommend. The statements of their merits are the statements of the makers, made to me over their own signatures.

MOLASSES AND MOLASSES FEEDS

The use of molasses and molasses feeds as an economical factor in the ration of the dairy cow has grown to an astonishing extent in the past five years, and continues to grow as their merits become better understood.

It is not difficult to find a reason for this. We have seen what a large part palatability has in the proper digestion and assimilation of the feed the dairy cow takes; and that the more she will take, digest, assimilate and return a profit on, the more valuable she is as a producer. Not cows alone, but all animals and most birds love sweets. Certainly it has been proven beyond any shadow of doubt that molasses by it-

self or in prepared feeds will tempt the cow to eat hay or fodder which she would otherwise refuse. What the chemist tells us as to the nutritive qualities of this sweet is not to be taken as a final dictum as to its value as a feed in the dairy, any more than what he tells us as to the value of beet pulp or roots can measure their use. We must be guided by what the cow tells us; and that is, in the case of molasses or molasses feeds, that she likes them, they are milk makers, and keep her in good condition. No cow can do her best work unless she is in perfect health. Molasses and molasses feeds contribute to that end.

Longer than the memory of the writer runs, and that is many years, molasses or sugar has been used in the fattening of steers.

For a long period of time molasses in various forms has been fed horses in Europe, replacing an equal weight of grain. M. Lavalard, veterinary surgeon to the Paris General Omnibus Co., which keeps 15,000 horses, gives a most interesting account of the feeding of a molasses feed composed of from 80% to 86% of molasses. He says:

"Gradually the whole of the company's horses, 15,000 in number, were getting two to four pounds. There has been a surprising decrease in the number of cases of colic, and since its use there has not been a single one of diarrhoea." Later the molasses feed was raised to six pounds a day. He further remarks: "It was most striking, the way in which the whole of the food was picked up, the mangers being quite cleared out, which under the former system seldom happened."

There seems to be a prejudice against a free use of molasses or molasses feeds on the part of some who do not know from practical experience the benefits following their use for the dairy cow. These people believe that diarrhoea follows their use and that even the milk will cause this trouble in children, which is erroneous. If molasses made from sugar beets is used in the preparation of these feeds, there might be some reason for this belief; because it is well known that this contains a large amount of potash salts which exert a strong purgative action on animals; but the molasses feeds and the molasses usually sold for dairy cattle are made from cane. It is cane molasses or "blackstrap." According to Dr. Chas. A. Brown, formerly chemist of the Sugar Experiment Station of the Louisiana Agricultural College, "cane molasses as compared with the beet contains 25% more of sugars." Bulletin No. 115 of this college shows that a large number of horses were fed heavily and continuously on cane molasses, and there was "a marked diminution in the number of cases of dietetic ailments such as colic, etc., and the health, and, therefore, the capacity of the animals for work, being very much improved, all of which should certainly be taken into consideration when estimating results from the standpoint of economy."

The fact that molasses and molasses feeds are fed whole herds of dairy cows year in and year out with no ill effects on the bowels of the animals, and with benefit to their health, is sufficient refutation of this mistaken idea that milk from molasses-fed cows will injure infants because it has a too laxative effect on the cattle. As a matter of fact it aids in the digestion of other feeds.

The following statement from the Miner Laboratories, on the fertilizing value of molasses feeds, is both interesting and timely:

"Molasses feeds, owing to the fact that most of them contain concentrates in addition to the molasses itself, carry considerably larger percentages of fertilizer ingredients than do the natural grains. The following shows the percentages of Nitrogen, Phosphorus and Potash in a standard molasses feed compared with oats, corn and wheat.

"Corn has 1.7% nitrogen; wheat, 1.9%; oats, 1.8%, and Sucrene Dairy Feed, 2.94%. Corn has .71% phosphoric acid; wheat, .55%; oats, .78%, and Sucrene Dairy Feed, 1.02%. Corn has .57% potash; wheat, .87%; oats, .48%, and Sucrene Dairy Feed, 1.65%."

CALF RAISING

In raising calves, some like to leave the calf with the cow or within her sight for from two to four days, while others prefer to take it away as soon as born and do not allow it to suck the cow at all. Those who adopt the latter plan claim the cows fret less and the calf will learn to drink milk more readily.

Under any circumstances the calf must have its mother's colostral milk to cleanse its digestive tracts.

When the calf is allowed to remain with the cow, have a small pen, boarded off in the corner of the box stall with a swinging gate, and keep the calf in it for three to four days, always in the mother's sight, thus keeping her from fretting until all fear of milk fever is past. The calf can be readily let out to its mother.

If the calf sucks the cow, it is important that it should not be allowed to gorge itself at any time. The greatest fear in calf raising is over-feeding. Little and often is a good rule.

When teaching the calf to drink from a pail let it go without anything for twenty-four hours so it will be hungry; but care should be taken that it is not allowed to gorge itself.

About 7 to 9 lbs. a day in three feeds is ample for a Guernsey or Jersey calf, and for a larger breed from 9 to 11 lbs. a day for the first week.

The calf should have the mother's milk for at least one week.

After that, it need not be its own dam's milk.

When fed by hand the milk must always be at blood heat, from 95 to 100 degrees Fahr., and must always be fed in a clean pail. A tin pail is preferable, as wood is hard to keep sweet and clean. All foreign substances such as hairs, flies, etc., must be kept out of the milk, and it is best to strain it before feeding the calf.

The third week, if the calf is thriving, the change to part skim milk may begin.

This change must be gradual, say about one pint per day being substituted for whole milk. Calves of the average size should get about 12 lbs. a day when the change begins, so that the following would be about the respective quantities:

	Whole Milk lbs.	Skim Milk lbs.
First Day	11	1
Second Day	10	2
Third Day	9	3
Fourth Day	8	4
Fifth Day	7	5
Sixth Day	6	6
Seventh Day	5	7
Eighth Day	4	8
Ninth Day	3	9
Tenth Day	2	10
Eleventh Day	1	11
Twelfth Day	0	12

Skim milk must also be fed at blood heat.

NEVER JUDGE THE TEMPERATURE OF THE MILK BY THE FINGER—USE A DAIRY THERMOMETER which costs but a trifle. Using the finger is absolutely misleading.

When the calf is about six weeks of age a gradual change to cold milk can be made. While it is generally advisable to keep calves partly on skim milk until three to four months old, they can, according to the Illinois Experiment Station, be put on grain successfully at the end of two months.

A wisp of hay, preferably clover or alfalfa, should be in front of the calves always, after they are two weeks old, suspended a little higher than their heads so that they will, in beginning to play with it, nibble the hay. It is surprising to see how quickly they will learn to eat the hay. Grain, consisting of crushed oats and bran in equal parts, and about a tablespoonful of linseed oil meal to one quart of the mixed feed, should be before the calves at all times. As they will put their muzzles while still wet with milk into this grain, the latter must be constantly changed to keep it from souring.

It is a good practice to have a little bonemeal, charcoal and salt where the calf can get it at all times; the charcoal to act as an aid to digestion and a purifier, and the bonemeal and salt to give ash.

It is advisable to have small stanchions in which to feed the calves while they are getting their milk, either whole or skimmed, and to leave them in the stanchions for a time after they have finished their milk, as they are apt to suck each other's ears or teats after taking the milk.

If they have access to grain in a box, after they have taken their milk, they are not so likely to suck each other.

NEVER MAKE ANY ABRUPT CHANGE IN FEEDING CALVES

The essentials for successful calf raising are: bright quarters, with plenty of sunlight reaching every part of the pens; plenty of clean bedding; milk fed at blood temperature each time; frequent feeding and not too much at once; clean utensils and milk free from all foreign matter.

If calves are turned into pasture at the end of six months it will be best to supplement the pasture by some grain feed.

We do not believe calves can be raised on calf meal wholly, after the mother's milk is fit for consumption; but there is no question that by the use of calf meals, the amount of milk needed for the calf can be materially reduced.

TABLE OF DIGESTIBLE NUTRIENTS

SOILING FODDERS.

Kind and Amount of Feed		Dry Matter	Protein	Total Carbohydrates	Ratio
	lbs.	lbs.	lbs.	lbs.	
Fodder corn	1	.20	.010	.125	1:12.5
	15	3.00	.150	.875	1:12.5
Peas and oats	1	.16	.018	.076	1:4.2
	15	2.40	.270	1.140	1:4.2
Peas and barley	1	.16	.017	.077	1:4.5
	15	2.40	.255	1.155	1:4.5
Red clover	1	.29	.029	.164	1:5.6
	15	4.35	.435	2.460	1:5.6
Alfalfa	1	.28	.039	.138	1:3.5
	15	4.20	.585	2.070	1:3.5
Hungarian grass	1	.29	.020	.169	1:8.4
	15	4.35	.300	2.535	1:8.4
Alsike clover	1	.25	.026	.125	1:4.8
	15	3.75	.390	1.875	1:4.8
Millet	10	1.1980	.080	1.230	1:14.4
	15	2.970	.120	1.845	
Crimson clover	1	.19	.024	.122	1:4.2
	15	2.85	.360	1.530	1:4.2
Cowpea	1	.16	.018	.092	1:5.1
	15	2.40	.270	1.380	1:5.1
Soy bean	1	.25	.031	1.121	1:3.9
	15	3.75	.465	1.815	1:3.9
Rye in head	1	.23	.021	.150	1:7.1
	15	3.45	.310	2.250	1:7.1
Green sorghum	10	2.060	.060	1.290	1:20.5
	15	3.090	.090	1.935	
Pasture grass	1	.20	.023	.157	1:6.8
	15	3.00	.345	1.355	1:6.8
Corn silage	1	.21	.009	.129	1:14.3
	15	3.15	.135	1.935	1:14.3
	20	4.20	.180	2.580	1:14.3
	25	5.25	.225	3.225	1:14.3
	30	6.30	.270	3.870	1:14.3
Pea vine silage	1	.232	.021	.170	1:7.1
	15	3.480	.315	2.550	1:7.1
	20	4.640	.420	3.400	1:7.1
	25	5.800	.525	4.250	1:7.1
	30	6.960	.630	5.100	1:7.1

DRY FODDERS.

Timothy hay	10	8.70	.280	4.650	1:16.6
	15	13.05	.420	6.975	1:16.6
Mixed grasses and clover..	10	8.70	.620	4.600	1:7.4
	15	13.03	.930	6.900	1:7.4
Oat and pea hay	10	8.90	.760	4.487	1:5.9
	15	13.35	1.040	6.730	1:5.9

Kind and Amount of Feed		Dry Matter	Protein	Total Carbohydrates	Ratio
	lbs.	lbs.	lbs.	lbs.	
Red clover hay	10	8.50	.680	3.960	1:5.8
	15	12.75	1.020	5.940	1:5.8
Alsike clover hay	10	9.00	.840	4.220	1:5.6
	15	13.50	1.260	6.330	1:5.6
Crimson clover hay	10	9.04	1.050	3.760	1:3.5
	15	13.56	1.575	5.640	1:3.5
Cowpea hay	10	8.95	1.000	4.220	1:4.2
	15	13.42	1.500	6.330	1:4.2
Soy bean hay	10	8.82	1.060	4.360	1:4.1
	15	13.23	1.590	6.540	1:4.1
Alfalfa hay	10	9.20	1.100	4.230	1:3.8
	15	13.80	1.650	6.345	1:3.8
Corn fodder	5	2.90	.125	1.865	1:14.9
	10	5.80	.250	3.730	1:14.9
	15	8.70	.375	5.595	1:14.9
Corn stover	5	3.00	.085	1.700	1:19.9
	10	6.00	.170	3.400	1:19.9
	15	9.00	.255	5.100	1:19.9
Oat straw	5	4.54	.065	2.065	1:31.7
	10	9.08	.130	4.130	1:31.7
	15	13.62	.195	6.195	1:31.7
Wheat straw	5	4.50	.020	1.860	1:93.0
	10	9.00	.040	3.720	1:93.0
	15	13.50	.060	5.580	1:93.0
ROOTS, TUBERS, ETC.					
Potatoes	5	1.05	.045	.825	1:18.3
	15	3.15	.135	2.475	1:18.3
	20	4.20	.180	3.300	1:18.3
Cabbage	5	.75	.090	.445	1:5.1
	15	2.25	.070	1.365	1:5.1
Apples	5	.95	.035	.940	1:26.8
	15	2.85	.105	2.820	1:26.8
	20	3.90	.140	3.760	1:26.8
Dried beet pulp	1	.92	.041	.649	1:15.8
	2	1.84	.082	1.298	1:15.8
	3	2.76	.123	1.947	1:15.8
Mangels	5	.45	.055	.280	1:5.1
	15	1.35	.165	.840	1:5.1
	20	1.80	.220	1.120	1:5.1
Sugar beets	5	.65	.055	.520	1:9.4
	15	1.95	.165	1.560	1:9.4
	20	2.60	.220	2.080	1:9.4
Carrots	5	.55	.040	.410	1:10.3
	15	1.65	.120	1.230	1:10.3
	20	2.20	.160	1.640	1:10.3
Flat turnip	5	.50	.050	.385	1:7.7
	15	1.50	.150	1.155	1:7.7
	20	2.00	.200	1.540	1:7.7
Rutabagas	5	.570	.050	.480	1:8.6
	15	1.710	.200	1.440	1:8.6
	20	2.280	.250	1.920	1:8.6
CONCENTRATES.					
Peanut cake	1	.89	.428	.366	
Cottonseed meal	1	.92	.372	.444	1:1.2
Chicago gluten meal	1	.88	.322	.468	1:1.5
Linseed meal, O. P.	1	.91	.293	.485	1:1.7
Linseed meal, N. P.	1	.90	.282	.464	1:1.6
Soy bean meal	1	.88	.291	.561	1:1.9
Distillers' dry grains	1	.92	.248	.552	1:2.2

Kind and Amount of Feed		Dry Matter	Protein	Total Carbohydrates	Ratio
	lbs.	lbs.	lbs.	lbs.	
Buffalo gluten feed	1	.90	.232	.699	1:3.0
Culled beans	1	.86	.226	.759	1:2.4
Buckwheat mids.	1	.87	.220	.456	1:2.1
Malt sprouts	1	.90	.186	.409	1:2.2
Peas	1	.90	.168	.534	1:3.2
Brewers' dry grains	1	.92	.157	.478	1:3.0
Red Dog flour	1	.90	.135	.658	1:4.9
Wheat mids.	1	.88	.128	.607	1:4.7
Wheat bran	1	.88	.122	.453	1:3.7
Rye bran	1	.88	.115	.548	1:4.8
Wheat	1	.90	.102	.730	1:7.2
Rye	1	.88	.099	.700	1:7.1
Oats	1	.89	.092	.568	1:6.2
Barley	1	.89	.087	.692	1:7.9
Low grade flour	1	.88	.082	.647	1:7.9
Corn	1	.89	.079	.764	1:9.7
Hominy chop	1	.89	.075	.705	1:9.4
Buckweat bran	1	.90	.074	.347	1:4.7
Corn and cob meal	1	.85	.044	.665	1:15.1
Brewers' wet grains	1	.24	.039	.125	1:3.2.
SUNDRIES.					
Sugar molasses		.74	.014	.606	1:4.4
Skim milk	1	.09	.029	.059	1:2.0
Buttermilk	1	.10	.039	.065	1:1.7

COST OF PROTEIN

A great many feeders labor under the impression that those grains or feeds which cost the least per ton are the cheapest. This is a mistake. We usually feed them to supply the protein lacking in home-grown grains, which latter generally give a surplus of carbohydrates and are deficient in protein.

When protein is needed we should select those feeds or grains giving a pound of that element at the least cost, due regard being had to their being right ones to combine with those home grown; that is, if the rations from home grown grains contain heavy feeds, we should select light ones, or if light feeds, we should select heavy ones.

The following table is given as showing the cost per pound of digestible protein in those grains or feeds usually fed on the farm. The prices are the average in an Eastern state for 1913, and the amount of digestible protein in each ton is as set out in Bulletin 154, Cornell University, where it gives them, or from Henry on "Feeds and Feeding":

TABLE A.

Grain or Feed	Protein in Each Ton lbs.	Cost per Ton	Cost per lb. Protein
Corn meal	158	$26.90	$.170
Hominy chop	150	26.04	.173
Grd. oats	184	26.89	.146
Barley feed	174	25.36	.145
Rye	199	26.06	.131
Red dog flour	270	29.74	.110

Grain or Feed	Protein in Each Ton lbs.	Cost per Ton	Cost per lb. Protein
Wheat midds.	256	25.87	.101
Wheat bran	244	23.49	.096
Brewers' wet grains	314	*23.00	.073
Distiller's dry grains	496	30.64	.061
Gluten feed	464	27.51	.059
Malt sprouts	372	20.99	.056
Buck midds.	440	25.00	.056
Linseed meal	586	31.05	.053
Cotton seed meal	744	31.49	.042

*Estimated.

These figures prove that those grains or feeds containing the most protein cost the most per ton; but they also give a pound of protein at the lowest cost. Malt sprouts are the exception. There is a large supply of them and comparatively little demand.

HAYS.			
Timothy	56	$21.38	$.381
Mixed grasses and clover	124	17.09	.137
Clover	136	18.00	.132
Alfalfa	220	25.00	.113
Soy bean	212	*.....	...
Crimson clover	210	.....	...
Cowpea	184	.....	...
Alsike clover	168	.....	...
Oat and pea	152	.....	...
Oat hay	94	.....	...
STRAWS.			
Soy bean	46	.....	...
Oat	26	.....	...
Wheat	16	.....	...
Corn fodder	50	.....	...
Corn stover	34	.....	...

*Where prices vary a great deal they are not given. They can readily be found by dividing the cost per ton by the number of pounds of protein in the ton.

Following are rations showing the cost per pound of protein with various combinations of grains and roughages.

WITH TIMOTHY HAY

This example is given merely to show how expensive is any ration with timothy as roughage. It is not commended, as timothy is no fit food for a dairy cow.

	Dry Matter lbs.	Protein lbs.	Carbs lbs.	Cost
13 lbs. timothy	11.31	.364	6.445	$.1389
30 " corn silage	6.30	.270	3.870	.0525
2 " wheat bran	1.76	.244	.906	.0234
3 " distillers' dry grains	2.76	.744	1.656	.0459
1¾ " cotton seed meal	1.61	.650	.777	.0275
¾ " linseed meal	.68	.220	.364	.0116
7½ Ratio 1:5.6	24.42	2.492	14.018	.2998

Cost of 1 lb. of protein, $.1248.

Feed 1 lb. of grain mixture to every 3 or 4 lbs. milk, according to the fat per cent. It was necessary to use grains extremely rich in protein and high in cost per ton to reduce the ratio from 1:16.2 in the roughage, to 1:5.6.

If any cow becomes thin on this, or any other ration where corn is not used, feed from ½ to 1 lb. of corn meal, or hominy, per day, regardless of whether it unbalances the ration, or not. The fact that she becomes thin shows that she needs more carbonaceous food for maintenance.

MIXED HAY AND CORN SILAGE.

	Dry Matter lbs.	Protein lbs.	Carbs lbs.	Cost
12 lbs. mixed hay	10.44	.744	5.520	.1025
30 " corn silage	6.30	.270	3.870	.0525
(Ratio 1:9.1)	16.74	1.014	9.390	.1550
3 lbs. wheat bran	2.64	.366	1.359	.0352
2 " distillers' dry grains	1.84	.496	1.164	.0306
1½ " corn meal	1.35	.118	1.046	.0202
½ " linseed oil meal O. P.	.46	.146	.242	.0078
1 " cotton seed meal	.92	.372	.382	.0157
(Ratio 1:5.4)	23.95	2.512	13.583	.2645

Cost of 1 lb. of protein $.105.

Feed 1 lb. grain to every 3 lbs. to 4 lbs. milk, according to the fat percentage. This is a cheap ration, but with the exception of corn meal everything must be bought from the dealer.

ALFALFA AND CORN SILAGE.

	Dry Matter lbs.	Protein lbs.	Carbs lbs.	Cost
10 lbs. alfalfa hay	9.20	1.100	4.230	$.1250
35 lbs. corn silage	7.35	.315	4.515	.0612
(Ratio 1:6.1)	16.55	1.415	8.745	.1862
2 lbs. corn meal	1.73	.158	1.528	.0269
2 lbs. gluten feed	1.80	.464	1.398	.0275
2½ lbs. wheat midds	2.20	.320	1.517	.0323
½ lb. ground oats	.45	.043	.284	.0067
½ lbs. linseed oil meal	.44	.146	.242	.0078
(Ratio 1:5.4)	23.17	2.546	13.714	.2874

Cost of 1 lb. of protein, $.113.

Feed 1 lb. grain to every 3½ lbs. to 4½ lbs. milk, according to fat percentage. While this ration costs more per pound of protein than ration No. 2, such increased cost is due wholly to the high price of alfalfa hay. If the farmer grows his own alfalfa, as he should, the cost will be less, so far as grain is concerned, than in ration No. 2.

ALFALFA HAY, CORN STOVER AND CORN SILAGE.

	Dry Matter	Protein	Carbs	Cost
	lbs.	lbs.	lbs.	
8 lbs. alfalfa hay	7.36	.880	3.384	$.1000
8 lbs stover	4.80	.136	2.720	.0240
30 lbs. corn silage	6.30	.270	3.870	.0525
(Ratio 1:8.4)	18.46	1.286	9.974	.1765
3 lbs. distillers' dry grains	2.76	.744	1.656	.0134
2 " wheat bran	1.76	.244	.906	.0235
1 " corn meal	.89	.079	.764	.0459
¾ " linseed oil meal (O. P.)	.66	.216	.362	.0117
(Ratio 1:5.5)	24.53	2.569	13.662	$.2710

Cost of 1 lb. of protein, $.105.

Feed 1 lb. of grain to every 3½ to 4½ lbs. milk, according to fat percentage. This is another cheap ration, one reason being that stover is used, reducing the amount of alfalfa hay needed.

PRINCIPALLY FARM GROWN CROPS

MIXED HAY AND CORN SILAGE.

	Dry Matter	Protein	Carbs	Cost
	lbs.	lbs.	lbs.	
12 lbs. mixed hay	10.44	.744	5.520	$.1025
30 " corn silage	6.30	.270	3.870	.0525
(Ratio 1:9.1)	16.74	1.014	9.390	.1550
3 lbs. ground oats	2.67	.276	1.704	.0403
3 " buck midds	2.61	.660	1.369	.0127
1 " barley chop	.89	.087	.692	.0375
¾ " linseed oil meal	.68	.220	.584	.0116
¾ " cotton seed meal	.69	.279	.333	.0118
(Ratio 1:5.5)	24.28	2.536	14.072	.2689

Cost of 1 lb. of protein, $.106.

Feed 1 lb. grain to every 3 lbs. to 4 lbs. milk, according to the percentage of fat. It will be noted that the total expenditure for grains that cannot be grown on the farm is 2.34c.; the cost of a pound of protein is low, it is a well balanced ration, yet gives succulence, palatability and variety.

PRINCIPALLY FARM GROWN CROPS

CLOVER HAY AND CORN SILAGE.

	Dry Matter	Protein	Carbs	Cost
	lbs.	lbs.	lbs.	
12 lbs. clover hay	10.20	.816	4.782	$.1080
30 " corn silage	6.30	.270	3.870	.0525
(Ratio 1:7.9)	16.50	1.086	8.652	.1605
3 lbs. buck midds	2.61	.660	1.368	.0375
3 " ground oats	2.67	.276	1.704	.0403
1 " corn meal	.89	.079	.746	.0134
1 " barley chop	.89	.087	.692	.0127
½ " linseed meal (O. P.)	.45	.146	.242	.0078
½ " cotton seed meal	.46	.186	.222	.0079
(Ratio 1:5.4)	24.47	2.520	13.626	.2801

Cost of 1 lb. of protein, $.111.

Feed 1 lb. grain to every 3 lbs. to 4 lbs. milk, according to the fat percentage. This ration is slightly more expensive than No. 5, due to the fact that 12 lbs. clover hay costs more than the mixed hay in the latter, and we have used more home grown grains and less bought feed, the latter amounting to but 1.57 cents.

ENTIRELY FARM GROWN CROPS

ALFALFA HAY AND CORN SILAGE.

	Dry Matter lbs.	Protein lbs.	Carbs lbs.	Cost
12 lbs. alfalfa hay	11.04	1.320	5.076	$.1500
30 " corn silage	6.30	.270	3.870	.0525
(Ratio 1:5.6)	17.34	1.590	8.946	.2025
4 lbs. ground oats	3.56	.368	2.272	.0269
2 " corn meal	1.78	.158	1.528	.0250
2 " buck midds	1.74	.440	.912	.0538
(Ratio 1:5.4)	24.42	2.556	13.658	.3082

Cost of 1 lb. of protein, $.12.

Feed 1 lb. of grain to 3 to 4 lbs. milk, according to percentage of fat. If droppings of cows are inclined to be hard, add a small quantity of molasses, about 1 pint per day, diluted with hot water, provided it does not cost more than fourteen cents a gallon.

IDEAL RATION FROM FARM GROWN CROPS ENTIRELY

ALFALFA HAY, CORN SILAGE AND SOY BEAN MEAL.

	Dry Matter lbs.	Protein lbs.	Carbs lbs.	Cost
10 lbs. alfalfa hay	9.20	1.100	4.230	$.1250
35 " corn silage	7.35	.315	4.515	.0612
(Ratio 1:6.1)	16.55	1.415	8.745	.1862
3 lbs. ground oats	2.67	.276	1.704	.0403
1 " barley chop	.89	.087	.692	.0269
2 " corn meal	1.78	.158	1.528	.0126
2 " soy bean meal	1.76	.581	1.122	.0350
(Ratio 1:5.5)	23.65	2.517	13.791	.3010

Cost of 1 lb. of protein, $.119.

Feed 1 lb. of grain to each 3 to 4 lbs. milk, according to the percentage of fat.

This is an ideal ration made entirely from crops that can be grown on most eastern farms. It is ideal because it furnishes the correct amount of dry matter, protein and carbohydrates in correct proportions and consequently is properly balanced; two-thirds of the dry matter is supplied by the roughage. It has variety and succulence and consequently is palatable. It has both light and heavy grains, thereby adding to digestibility. The heating grains are offset by cooling ones. If there is no barley available, use 4 lbs. of oats in place of 3 lbs. If no oats can be grown, use 4 lbs. of barley in place of 3 lbs. of oats and 1 lb. of barley.

ANOTHER ENTIRELY FARM GROWN RATION

MIXED HAY, SILAGE AND SOY BEAN MEAL.

	Dry Matter lbs.	Protein lbs.	Carbs lbs.	Cost
12 lbs. mixed hay	10.44	.744	5.520	$.1025
30 " corn silage	6.30	.270	3.870	.0525
(Ratio 1:9.2)	16.74	1.014	9.390	.1550
4 lbs. ground oats	3.56	.368	2.272	.0538
1 " barley chop	.89	.087	.692	.0126
3½ " soy bean meal	3.08	1.018	1.863	.0612
(Ratio 1:5.8)	24.27	2.487	14.217	.2826

Cost of 1 lb. of protein, $.113.

Feed 1 lb. of grain to every 3½ to 4 lbs. milk, according to the percentage of fat.

While this is not quite so well balanced a ration as No. 8 and has a trifle too much carbohydrates compared with protein (is too wide) for a Guernsey or a Jersey, it is well adapted to cows of other breeds.

USING OAT STRAW, MIXED HAY AND CORN SILAGE.

	Dry Matter lbs.	Protein lbs.	Carbs lbs.
7 lbs. mixed hay	6.00	.434	3.220
7 " oat straw	6.31	.084	2.828
25 " corn silage	5.25	.225	3.225
(Ratio 1:11.1)	17.56	.743	9.273
3 lbs. wheat bran	2.64	.366	1.359
3 " gluten feed	2.70	.696	2.097
1½ " cotton seed meal	1.38	.558	.666
1 " dry brewers' grains	.92	.159	.478
(Ratio 1:5.5)	25.20	2.520	13.873

Feed 1 lb. of grain to each 3 to 4 lbs of milk according to the percentage of fat.

Note that the roughage in Ration Nos. 2, 5 and 9, when mixed hay and silage are used, each furnish 1.014 lbs. of protein, 9.390 lbs. of carbohydrates and that the ratio is 1:9.1. Where the oat straw is used the ration gives but .743 lbs. of protein, and the ratio is 1:11.1. While not much more grain is used in this ration, it costs more per pound, due to its higher protein content. We cannot give the total cost on account of the varying cost of oat straw.

WITH ROOTS, TURNIPS, MANGELS, SUGAR BEETS.

	Dry Matter	Protein	Carbs	Cost
12 lbs. mixed hay	10.44	.744	5.520	$.1025
60 " mangels	5.40	.660	3.360	.1800
Ratio 1:6.3	15.84	1.404	8.880	.2825
4 lbs. corn and cob meal	3.40	.176	2.660	.0320
2 " gluten feed	1.80	.464	1.398	.0275
1 " wheat midds	.88	.128	.607	.0129
1 " cotton seed	.94	.372	.444	.0157
Ratio 1:5.5	22.86	2.544	13.989	.3706

Cost of 1 lb. protein, $.147.

Feed 1 lb. grain to each three to four pounds of milk, according to the per cent. of fat.

If 60 lbs. of flat turnips are substituted for mangels, omit the corn and cob meal and the wheat middlings, and use in their stead 2 lbs. corn meal, increase the gluten feed to 3 lbs. and use 1 lb. cottonseed meal, so that the grain ration will be as follows: 3 lbs. gluten feed, 2 lbs. corn meal and 1 lb. cottonseed meal.

WITH SUGAR BEETS

If 60 lbs. sugar beets are fed in place of mangels, omit the corn and cob meal, gluten feed, and the wheat middlings in the mangel ration, and substitute 3 lbs. of Ajax for the gluten feed. The grain ration will then be: 3 lbs. Ajax and 1 lb. cottonseed meal.

Use 12 lbs. of mixed hay for a thousand-pound cow with any of the above roots.

Mangels are figured at $6.00 per ton, corn and cob meal at $16.00 per ton to accord with average price of other grains in 1913.

TO MAKE THE COW LIVE UP TO HER INHERITANCE IN PRODUCTION IT IS NECESSARY TO KEEP HER GROWING FROM THE TIME SHE IS BORN UNTIL SHE COMES INTO MILK. She should never be allowed to go back; if she does, it will be at the expense of future usefulness.

There is no time in the life of a heifer when it is more important that she should be properly fed than the two months before she comes in and the thirty days afterward.

In the two months before she becomes a mother, the unborn calf grows more than it does for any four months preceding. The material wherewith to make this growth must be given the mother through the feed. We have seen that ash is needed for the framework of the calf, and protein is the element from which the hair, hide and hoofs are made. The mother must also give the calf a great deal of blood at this time. Unless she is fed a surplus of protein over that she needs for her own maintenance, she will give the calf the material needed for these purposes if she can, taking it off of her own body, and thereby becoming thinner all the time.

Just now the heifer has also to build up her own udder tissues; and we have seen that protein is needed for tissue. We are firmly convinced that a heifer fed a surplus of protein for two months before she calves will not only produce a stronger and healthier calf, and be made capable of giving more milk, but she will also build herself a larger udder than where she is stinted in protein.

With the exception of the building of the udder, the same applies to dry cows; and it is just as necessary for the future production in the next lactation that dry cows should be fed a goodly amount of protein as that heifers should.

Our experience is that ONE BAG OF FEED FED WHILE THE COW IS DRY IS WORTH TWO AFTER SHE COMES IN.

Unless this system is adopted, the dry cow or the incoming heifer will take the protein from the lean meat on her back for the purposes as specified, and become constantly thinner. When she comes in, it

will therefore be needful to give her the milk-making feeds more rapidly than we believe desirable at this time. No cow can go through the act of parturition without all the digestive tracts being considerably unsettled. Her udder is extremely tender at that time, and if she is fed heating feeds, which are usually those rich in protein, she is much more likely to develop udder trouble than if she is fed cooling feeds for the ten days after she comes in.

The whole object of this system of feeding, which we have found by experience will increase the production 20% at least over what a cow will give if she come in thin, is to put protein in the form of lean flesh on her body before she calves, so that she can draw on it to put the caseine (another protein) in her milk and obviate the necessity of feeding her rich protein feeds, which as stated, are generally heating. This is not a theory; we have practiced it for many years and never failed to find it most effective in milk production.

The following ration we have used very successfully for incoming heifers and calves; but any milk making ration that is being fed the herd can be used, provided there is a goodly quantity of bran in it as well as linseed oil meal. This milk making ration should be fed to within ten days of calving, when another ration consisting of equal amounts of ground oats and bran should be substituted for the milk making one, to which can be added one-half pound of linseed oil meal. A total of 5 lbs. to 7 lbs. per day of the combined ration, according to the size of the cow, may be fed up to calving. Feed also a slightly smaller quantity of corn silage than before she was dry, roots or dried beet pulp, and all the hay the cow will eat. Below is the ration we suggest:

150 lbs. distillers' dried grains (from corn).
100 " wheat bran.
100 " ground oats.
50 " linseed oil meal (O. P.).
50 " cottonseed meal.
50 " hominy chop or corn-and-cob meal, ground fine.

Feed from 5 lbs. to 7 lbs. of the above grain ration, according to size of animal, to all dry cows or incoming heifers up to within ten days of due date; all the mixed hay the animal will eat, and from 20 lbs. to 30 lbs. (according to size) of silage or other succulent per day. If alfalfa or clover hay is used, decrease the distillers' dried grains to 100 lbs. and increase the corn meal to 75 lbs.

The bran helps to keep the bowels in good condition and furnishes ash; the oats and bran are cooling; the linseed oil not only acts on the bowels favorably, but also prevents trouble with retention of the afterbirth.

Just before the cow calves, or immediately after, give her a drench of 1 lb. to 1½ lbs. Epsom salts, according to her size, 3 heaping tablespoons of ground ginger and 1 qt. molasses, all dissolved in hot water.

For the first three days after the cow calves she should be fed no grain, but ground oats and wheat bran as a mash, hot, to which should be added about a handful per day of linseed oil meal. Continue the feeding of succulents and hay. She should have all the water she will drink, but it must be warm; and if she is given warm water for an-

other week afterward, it will aid materially in increasing the milk flow. If she is chilled by drinking very cold water, her milk flow is often checked, temporarily at least.

Assuming that the cow or heifer has accumulated on her body lean flesh, the following is our system of feeding her to bring her to her full flow.

When she begins to increase in her milk, say the fourth or fifth day, instead of feeding her any of the milk making ration we will use later on, we increase the bran and oat mixture, a total of ½ lb. per day only; then ½ lb. the next day, and ½ lb. thereafter every day as long as she responds to the increase by an increased flow. If on the contrary, when you are increasing her feed daily she goes back, **take off ½ lb. for a day or two** and she will usually increase her milk again. When a cow has been in milk for some time and an increase of feed is given her, and she goes down in her yield instead of increasing, by taking off some of her feed you can often make her come up again. With very heavy milkers or cows with very large frames, it may be needful to make the daily increase of feed more than ½ lb. Our whole object in increasing it so slowly is to avoid overtaxing the digestion, which will usually make her jump in her yield, then suddenly go down and never fully recover until she calves again. She has in reality had indigestion.

Continue increasing the ration through bran and oats, with linseed meal, until the end of ten or fourteen days after the cow calves. Then begin to substitute the rich, or milk-making ration, using ½ lb. a day for a smaller cow and more for a larger one, for ½ lb. of the lighter ration; and continue this method until she is entirely on the rich ration. If her flow of milk justifies an increase of feed any time during the process, let the added feed be from the **light ration** rather than from the rich one.

By the time the cow is put on the rich ration she has wholly recovered from her calving and all fear of udder trouble has probably passed; consequently she will continue to increase from day to day until her maximum yield is reached.

The cow is her own chemist and has made her milk with exactly the right proportions of protein, carbohydrates, fats and ash, even while we were feeding her lightly, by taking from the flesh she had stored up on her body the necessary elements which were given her in the feed while she was dry, and she will still be in good condition. Of course it is understood that the cow must be completely dried off before the ration for dry cows is fed her. All cows are better for having sixty days' rest.

If the cow or heifer has not put on a surplus amount of lean flesh, it will be necessary to begin to substitute ½ lb. of the rich ration daily for a smaller cow and more for a larger cow earlier; say the fourth or fifth day after calving, because she has not the lean body flesh to draw upon.

In feeding individual A. R. cows or where feeding entire commercial herds, we have made increased flows of from 20% to 50% on the average for the entire year. We are convinced that while a certain amount of the increased milk production came from feeding a better

ration than the cows had been getting, a large proportion was secured through the above system of feeding before the cows came in and the first twenty-one to thirty days afterward. Our experience has always been that a cow brought to her milk slowly hangs to it more tenaciously than one that comes up quickly.

At first sight this might appear an expensive process but in reality it is not. If the cow is very thin when she comes in, she must be fed heavily to get her up to her flow; and those feeds must be rich in protein, which are the most expensive of all. Apart from the extra profit of the increased milk flow induced by having the cow calve in good flesh, the actual cost of the extra feed given her when dry will not be much in excess of what is saved in the first twenty-one days after she calves, and you will have a better and longer flow besides.

It might be thought that a cow calving in this good condition would be subject to udder trouble. She would if she was over-fat from corn or carbonaceous feeds. But our experience is that a cow with plenty of flesh—not fat—on her body, has less udder trouble than where she come in thin. The reason is that when she is in the latter condition we begin to feed her rich feeds before her system is able to take care of them, and we fever her.

Any good heavy milking cow is liable to have milk fever; but this has lost its terrors where a milk fever outfit is on hand and is properly used. Every dairyman should have one. He must be careful to see that the instrument is thoroughly sterilized in boiling water before inserting in the teats, and it should never be used with the bare hand, because if any bacteria are introduced into the udder, blood poisoning may follow.

Will such a system injuriously affect the future of the cow? We have adopted this system successfully for many years; we have been feeding one herd in A. R. work for three years where they have never lost a cow, have never had a really sick cow, but where there has been with every animal an increased flow every year; the cows less mature have grown larger and stronger, and the same cows, eight in number, increased their A. R. records as follows: In both milk and butter 66%.

This system is exactly what the title of this book implies: feeding cows for profit.

FINIS.

APPENDIX

The claims made for prepared feeds, as set out below, are those of the manufacturers over their own signatures. We have tried out all these feeds, in various combinations for rations, and unhesitatingly recommend them as honestly prepared and good feeds.

SCHUMACHER STOCK FEED.

Schumacher Stock Feed is a mixed feed composed of corn, oats, barley, wheat and cottonseed products, finely ground and thoroughly kiln-dried. Its guaranteed analysis is not less than 10% crude protein and 3.25% crude fats. Two forty-pound Holsteins, the record Ayrshire and the record Jersey cow had Schumacher Stock Feed as part of their rations.

THE QUAKER OATS CO.,
Per G. A. Chapman.

LARRO-FEED.

Larro-feed is a ready mixed ration composed of only pure high-grade straight feeding stuffs, viz; Dried Beet Pulp, choice cottonseed meal, gluten feed, dried distillers' grains (mainly from corn), wheat bran and wheat middlings. These ingredients are blended in a mixture that is a balanced ration with ordinary roughage. It is a perfectly safe feed, and a splendid milk producer.

Very truly yours,
THE LARROWE MILLING CO.,
Charles Staff, Secretary.

SUCRENE.

Sucrene Dairy Feed is composed of Cottonseed Meal, Gluten Feed, Ground and Bolted Grain Screenings, Linseed, Oat Clippings and Molasses. No better, healthier, palatable or profitable feed for dairy purposes can be devised. Actual feeding tests demonstrates it makes healthier and fleshier cows and more milk for less money than any other feed.

Very truly yours,
AMERICAN MILLING COMPANY,
By H. G. Atwood, President.

KATLEAT.

SEVENTY-SEVEN per cent. of KATLEAT is composed of Standard Cotton Seed Meal, Pure Corn Meal, Pure Cane Molasses, the balance being a filler of highly digestible hay product, and requiring less silage or roughage. It contains NO corn cobs, weed seeds, oat hulls, clippings, screenings, mill sweepings, or any mill by product. It does not require any additional concentrates to produce results, being a correctly balanced ration in itself, with certain roughages.

G. E. PATTESON CO.,
Per. P. McIntyre.

MOLASSINE MEAL.

MOLASSINE MEAL acts as an antiseptic in the stomach of the animal, purifying it, absorbing all noxious gasses, clearing the digestive tract of all harmfull bacteria. Nothing will take its place in your rations when working for an A. R. record. It enables you to force your cows to the limit without danger of impaired digestion.

MOLASSINE COMPANY OF AMERICA,
T. U. Hay, Manager.

ALLSTOCK MOLASSES GRAINS.

Allstock Molasses Grains are composed of highest grade dried brewers' grains and pure sugarcane molasses; absolutely free from adulteration or inferior materials of any sort. Manufactured by special process which includes maceration —and filtering and sterilizing of molasses. Exceptionally digestible and highly nutritive; stimulates milk flow and acts as mild tonic to physical system.

Very truly yours,
THE MEADER ATLAS CO.,
Per S.

INTERNATIONAL SPECIAL DAIRY FEED

International Special Dairy Feed is unequalled as a milk producer for use as an entire grain ration to be fed in combination with ensilage, hay or other roughage. This is the feed that makes your feed bill smaller and milk check larger.

INTERNATIONAL SUGAR FEED CO.,
Per H. T. Heydrick, Sales Manager.

INDEX

Abnormal fat 7
Absorption, effect of cottonseed meal 17
Alfalfa hay ration 26–28
Alfalfa vs. Silage 5
Alfalfa with green fodder 10
All-stock Molasses Grains 34
Amount to feed calf..... 20
Appendix 34
A. R. cows, increased yield 32–33
Ash, function of 3–4
Ash in bones 4
Ash in flesh 4
Ash in framework 30
Ash in milk 4
Ash, need for 3

Balanced ration, defined 4
Barley Chop 15, 27, 28, 29
Bedding for calves 21
Beets as succulent 5
Beet pulp as succulent 5
Benefits of dried beet pulp 13
Benefits of roots 5
Benefits of succulents 5
Body structure 3
Body, warmed by feed 3
Bone-meal for calves 21
Bones, per cent. of in body 5
Bran, wheat 16
Breaking down tissues 3
Brewers dry grains, ration 29
Brewers wet grains 16
Buckwheat middlings, ration 27–28
Burning feed in body 3
By-products of corn 14

Calf, amount to feed 20
Calf, change of milk for 21
Calf, growth before birth..... 30
Calf meal 22
Calf, need for cleanliness 20
Calf, overfeeding 20
Calf raising 20–31
Calf, sanitary quarters for 21
Calf, stanchions 21
Calves sucking ears, etc. 21
Calves, temperature of milk 20
Calving, care after 31–32
Calving cows, drench for 31
Calving feed after 32
Carbohydrates for thousand pound cow.... 8
Carbohydrates, functions of 3
Caseine defined 3
Caseine, how used 3
Caseine in milk 3
Change of milk for calf 21
Charcoal for calves 21
Clean milk for calves 21
Clover hay ration 27
Colostral milk for calves 20
Commercial feeds 18
Comparison costs silage, beet pulp 13
Concentrates, nutrients 23
Cooking feeds 7
Corn, by-products of 14
Corn meal 14
Corn meal, effects of 14
Corn silage 11
Corn silage, cost of 13
Corn silage, economy of 5
Corn silage rations 25, 26, 27, 28, 29
Corn silage vs. alfalfa 5
Corn silage vs. roots 5
Corn silage vs. soiling crops 5
Corn stover ration 27
Cost of dried beet pulp 13
Cost of production in pasture 5
Cottonseed meal 17
Cottonseed meal, effect on abortion 17
Cow, her own chemist 32
Cows, coming in 30–31
Cows, feeding when thin 26
Cows, scouring 5
Cows, testing each 4
Cows, variations in 4
Cows, why thin 3, 30

Defining ratio 4
Defining ration 4
Defining maintenance ration 4
Defining narrow ration 4
Defining wide ration 4
Digestibility 6
Digestibility need of 4
Digestible nutrients defined 4
Digestible nutrients in concentrates 23
Digestible nutrients in dry fodders..... 22
Digestible nutrients in roots 23
Digestible nutrients in soiling fodders .. 22
Digestible nutrients in sundries 24
Digestion, aiding 4
Digestive fluids, secretion of 7
Distillers dry grains 16
Drench for incoming cows 31
Dried beet pulp, benefits of 13
Dried beet pulp, cost of 13
Dried beet pulp, succulent 5, 13
Dry cows 3, 30
Dry cows, beet pulp for 13
Dry fodders 10
Dry fodders digestible nutrients 22
Dry matter, amount needed 8
Dry matter in roughage 8, 9

Energy, how furnished 3
Examples of fibre 8
Excess protein 3

Farm grown ration 27, 28
Fat, abnormal 7
Fat in first milk 7
Fat, how varying 7
Fat in milk 7
Fat in strippings 7
Fat, normal 7
Fat, where taken from 7
Feed, gluten 17
Feeding calves 20
Feeding cows after calving 31
Feeding incoming cows and heifers 31
Feeding molasses 5
Feeding, regularity of 7
Feeds, commercial 18
Feeds, cooking of 7
Feeds, molasses 18
Feeds, prepared 18
Feed, when to reduce 32
Fertilizers, molasses feeds as 20
Fibre 8
Fibre, amount of 8
Fibre, crude 8
Fibre, defined 8
Fibre, examples of 8
Fibre in grains 8
Fibre in grass 8
Fibre in hays 8
Fibre in roots 8
Fibre in straws 8
Fibre, laws against 8
Flesh, stored for use 32
Fodders, dry 10
Fodders, green 10
Fodders, protein in 11
Fodders, soiling, nutrients in 23
Fresh cows, feeding of 31, 32
Functions of ash 3, 4

Gluten feed 17
Gradual increase of feed 32
Grain for calves 21
Grains, brewers' wet 16
Grains, cost per pound protein 24, 25
Grains, distillers' dried 16
Grains, distillers' dried from corn 16
Grains, distillers' dried from rye 16
Grains, fibre in 8
Grains, mixing 14
Grains, number to feed 6
Grains, rich in protein 9
Grass, fibre in 8
Green fodders 10
Green fodders with alfalfa 10
Green fodders with mixed hay 10
Ground oats 15
Growth aided by feed 33
Growth of cow, need for 30
Growth of unborn calf 30
Guernsey ration 29

Hair, growth of 3, 30
Hand feeding, calves 20
Hay, cost per pound protein 25
Hay for calves 21
Hay for calves, when to feed 21
Hay, how made palatable 5
Hays, fibre in 8
Hays, protein in 11
Hay, timothy 10
Heifer, growing udder 30
Hoofs, growth of 30
Hominy chop 15
Hoofs growth of 30
Importance of roughage 9

Incoming cows, drenching 31
Incoming cows, need for protein 30, 31
Incoming cows, ration for 31
Increase of feed gradual 32
Increasing A. R. yields 32, 33
International Special Dairy Feeds 35
Jersey ration 29
June pasture 4
Katl-Eat 34
Kidneys, affected by roots 5
Kinds distillers dried grains 16
Larro-feed 34
Laws against fibre 8
Light feed after calving 31
Linseed oil meal 17
Linseed oil meal, how fed..... 17
Linseed oil meal as succulent 5
Liver, affected by roots 5
Maintenance ration defined..... 4
Mangel ration 29
Mastication 6
Middlings, wheat 16
Milk, change of for calf 21
Milk, colostral 20
Milk, fat in 7
Milk, mother's for calf 20
Milk, shrinkage of 3
Milk, skim for calves 20
Milk tainted by turnips 5
Milk, temperature for calves 20
Mineral matter in feed 3
Mixed hay rations 26, 27, 29
Mixed hay with green fodder 10
Mixing grains 14
Molasses 18
Molasses as succulent 5
Molasses, effect on infants 19
Molasses, feeding in Europe 19
Molasses feeds 18, 34
Molasses feeds as fertilizer 20
Molasses, fondness of cows for 5
Molasses grains 34
Molassine Meal 35
Molasses, prejudices against 19
Molasses, quantity to feed 5
Molasses with poor hay 5

Narrow ratio defined 4
Narrow ration defined 4
Nature's food 4
Nervous cows 4
Nutrients digestible in concentrates 23
Nutrients, digestible in dry fodders 22
Nutrients, digestible in roots 23
Nutrients, digestible in soiling fodders 22
Nutrients, digestible in sundries 24
Nutrients, three classes 3

Oat straw ration 29
Overfeeding calf 20

Palatability, effects of 5
Palatability, how obtained 5
Palatability, need of 4
Palatability of grains 5
Palatability of pasture 6
Palatability, result of 6
Pasture, calves turned on 22
Pasture, June 4
Pasture, water in 4
Prepared feeds 18
Protein, cost of various grains 24, 25
Protein, cost of various hays 25
Protein, cost of various straws 25
Protein, cost per pound in grain 24
Protein, cost per pound in hays 25
Protein cost per pound in straws 25
Protein excess, how used 3
Protein, for thousand pound cow..... 8
Protein functions of 3
Protein in fodders 11
Protein in hay 11
Protein in soiling crops 10
Protein in straws 11
Protein, need of in feed 3
Protein, shortage of 3

Raising calves 20
Ratio defined 4
Ratio, example of 4
Ratio of roughage 9
Ration, balanced defined 4
Ration for fresh cows 31
Ration for incoming cows 31
Ration, narrow defined 4
Ration, wide defined 4
Rations for Guernsey 29
Ration for Jersey 29
Rations with alfalfa 26, 27
Rations with farm grown crops.....27, 28, 29
Rations with oat straw 29
Ration with soy bean meal 28, 29
Ration with timothy hay 25
Ration with roots 29
Rebuilding tissues 3
Red Dog flour 15
Reducing feed 32
Regularity in feeding 7
Rich protein grains 9
Roots as succulents 5
Roots, benefits of 14
Roots, digestible nutrients in 23
Roots, expense to grow 5
Roots, fibre in 8
Roots, ration 29
Roots vs. corn silage 5
Roots, water in 5
Roughage, dry matter in 8, 9
Roughage, importance of 9
Roughage, ratio of 9
Roughages 8
Roughage, use of 8
Rye feed 15

Sample rations 25, 26, 27, 28, 29
Saving through silage 5
Schumacher Stock feed 34
Scouring of cows 5
Secretion of digestive fluids 7
Shrinking in milk 3
Silage, cost of low 5
Silage, preferred to alfalfa 5
Silage, quantity consumed 5
Silage, ration 26
Silage, saving by 5, 11, 12
Silage, summer 11
Silage vs. alfalfa 5
Silage vs. soiling crops 5
Silo 5
Soaking dried beet pulp 5
Soiling crops, protein in 18
Soiling crops vs. silage 5
Soiling fodders, nutrients in 22
Soy bean meal ration 28, 29
Stanchions for calf 21
Stored flesh, use of 32
Stover ration 27
Straws, fibre in 8
Straws, protein cost per pound 25
Straws, protein in 11
Strippings, fat in 7
Succulence, benefits of 5
Succulence in beets 5
Succulence in dried beet pulp 5
Succulence in mangles 5
Succulense in molasses 5
Succulence in roots 5
Succulence in turnips 5
Succulence, its functions..... 4
Succulence, need for 4
Sucking calves 2
Sucrene Feed 4
Sugar beet ration 29
Sugar beets, value of 30
Sugars in molasses 19
Sundries, digestible nutrients in 24
Sunlight for calves 21
Sweets, fondness of cows for 5

Temperature of milk for calves.....20, 21
Testing cows 4
Thin cows 3, 26, 30
Thousand pound cow, carbs. for 8
Thousand pound cow, protein for 8
Timothy hay 10
Timothy hay ration 25
Tissues, breaking down 3
Tissues of udder 3
Tissues, rebuilt by feed 3
Tubers, digestible nutrients in 23
Turnips as succulents 5
Turnips, ration 29
Turnips, tainting milk 5

Udder, heifer's growth of 30
Udder, tissues, how rebuilt 3
Udder trouble lessened 33
Unborn calf, growth of 3
Uses of roughage 8

Variation in cows 4
Variation in fat 7

Warmth of body 3
Water in pasture grass 4
Water in roots 5
Wet grains, brewers' 16
Wheat bran 16
Wheat middlings 16
Wide ration defined 4

Yields of A. R. cows increased 32

LIBRARY OF CONGRESS
0 002 826 830 0